SPECIAL AIRWORTHINESS INFORMATION BULLETIN

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http://www.faa.gov/aircraft/safety/alerts/SAIB

This is information only. Recommendations aren't mandatory.

Introduction

This Special Airworthiness Information Bulletin (SAIB) advises you, owners and operators of **all aircraft equipped with General Electric Aircraft Engines (GE) CF6-80C2 and CF6-80E1 series turbofan engines** of reports of on-going engine flameout events during flight and two recent incidents involving dual engine flameouts on twin engine airplanes. These engines are installed on Boeing B747, B767, and MD11 series airplanes and Airbus A300 and A330 series airplanes.

Background

Since the early 1990's, there have been 32 reported flameout events on airplanes with CF6-80C2 and CF6-80E1 series turbofan engines. Two of these events involved total power loss with a subsequent in-flight relight. In some of the events, high pressure compressor blade damage was noted and may have been caused by ice impact.

The primary cause of the flameouts is ice accretion in the core flowpath (booster area) during low power conditions (idle or descent) that sheds during throttle increase and results in a flameout. Exposure to high concentrations of ice crystals is believed to be associated with these events which have occurred at altitudes between 11,500 and 36,000 feet and were in or near convective weather systems. Convective weather is caused by deep lifting and condensation of air in an unstable atmosphere that can result in one or more of the following: deep cloud and anvil regions, areas of strong wind shear and turbulence, lightning, high condensed water content, heavy precipitation, and hail. In each event, the engines relit and continued to operate normally for the remainder of the flight.

Flight crews may not recognize the existence of ice crystals because they do not accumulate on cold airframe surfaces. However, as ice crystals melt, they can accumulate on the warm internal surfaces of turbine engines.

In some of these flameout events, the flight crew did not report any significant weather radar indications, due to the low reflectivity of the dry ice crystals. Neither the aircraft ice detector nor visual indications on the airframe indicated the presence of icing conditions. However, prior to some of the events, freezing of the total air temperature probe, which erroneously indicated zero degrees Celsius was observed. Also, light to moderate turbulence may also have been present. Some reports were made of apparent rain on the airplane windshield while in these conditions, even though it is not possible to have rain at the reported altitudes and ambient temperatures. This reported rain is likely to be ice crystals rapidly melting on the windshield. However, even with no readily identifiable icing indications to the flight crew, ice may accumulate on warm surfaces inside the engine and cause adverse engine operation.

The ice crystal phenomenon has only recently been identified as a serious potential environmental threat to turbine engines that can cause power loss and adverse engine operation. The ability to characterize it and reproduce it in a test facility is still under development by industry. The FAA continues to work with industry to understand and characterize the ice crystal environmental threat and its effect on turbine engines. Service experience has shown that some engines in addition to the CF6 are susceptible to adverse operation during sustained exposure to ice crystals. Adverse operation has included flameout, engine stall, power rollback, and compressor damage.

In the interim, the FAA is continuing to monitor GE's root cause investigation of the CF6-80C2 and CF6-80E1 series flameout problem due to ice crystals. In addition, we are continuing to monitor the revenue service experience. Boeing, Airbus, and GE have taken interim containment actions. Additional actions may be taken based on the ongoing investigation.

Interim Corrective Actions

GE has recently introduced new software for engine control units (ECUs) on CF6-80C2 engines installed on B767 and B747 airplanes. This software modifies the variable bleed valve (VBV) schedule to increase ice extraction from the core flowpath and provide improved flameout margin. The FAA is currently working on issuing an airworthiness directive that will mandate installation of the software revision for CF6-80C2 ECU engines installed on B767 and B747 airplanes.

The FAA is currently working with GE on certification of the remaining CF6-80C2 ECU and CF6-80E1 engine models to incorporate a similar VBV schedule change. GE is continuing to evaluate design changes for CF6-80C2 power management control engines (non ECU) to address the flameout problem due to ice crystals.

The FAA plans to mandate these engine design changes and corrective actions when they become FAA-certified and are available to the operators.
Both Boeing and Airbus have issued interim containment actions to address this problem. They include the following:

1) Procedures to maximize engine bleed during descent in certain weather conditions to increase the engine flameout margin and reduce the possibility of flameout due to ice crystals.

2) Procedures for turning on continuous ignition during descent in certain weather conditions for engines without autorelight capability to ensure immediate restart following a flameout event.

3) Information provided to the flight crews about high altitude engine restart characteristic to reduce the potential of flight crews aborting a normal high altitude engine auto relight following a flameout.

4) Maintenance procedures for engine borescope inspections following a flameout due to weather.

Recommendations

We recommend owners and operators accomplish the following:
1) At the earliest opportunity, install the new ECU software that incorporates the VBV schedule change for increasing ice extraction from the core flowpath. We recommend putting a priority on doing at least one of the two engines on twin engine airplanes.

2) Communicate this recommendation to flight crews and follow the Boeing and Airbus airplane procedures and instructions published on this subject.

3) Avoid convective weather activity whenever possible. Especially avoid flying over strong convective systems. If unavoidable, maintain vigilance for recognizing a potential ice crystal encounter as described in this SAIB and the potential for adverse engine operation.

4) Be aware that the ice crystal phenomenon may not always be visible on the weather radar.

5) Be aware that ice crystals may accumulate within the engine but will not accumulate on the cold airframe surfaces.

6) Provide timely notification of any potential weather related flameout events to GE and provide any related data and information requested. This information will help support the root cause investigation.

For Further Information Contact

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